International Journal of Engineering Inventions
e-ISSN: 2278-7461, p-ISSN: 2319-6491
Volume 3, Issue 3 (October 2013) PP: 51-55

Automatic Movement of Fire Brigade to Emergency Spot- An Intelligent Transport System

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ABSTRACT: *Now a day the fire accidents rate has been increasing day to day. Moreover emergency in the city have been increased and to bar the loss of life due to the fire accidents is more crucial. To implement this we introduce a scheme called AMFBVS(Automatic Movement of Fire Brigade Vehicle System).The main theme behind this scheme is to provide a smooth flow for the fire brigade vehicle to reach the accident spot in time and thus minifying the expiration. The idea behind this scheme is to implement an Intelligent Transportation System (ITS) which would control the traffic lights in the path of the Fire brigade. The Fire Brigade is controlled by the central unit which furnishes the most scant route to the Fire Brigade and also controls the traffic light according to the Fire Brigade location and thus reaching the accident place safely. The server determines the location of the accident spot; through the sensor systems in the vehicle/fire brigade, the server using shortest path method can guide the Fire Brigade to the accident spot. This scheme can be automated and can help the vehicle to find the correct path for movement of fire brigade to accident spot by controlling the traffic lights.*

KEYWORDS: *Global Positing System, Global System for Mobile communication, Geographical information System, Intelligent Transportations System ,Shortest Path Method*

I. INTRODUCTION

There is loss of life due to the delay in the arrival of fire brigade to the accident place. This delay is mainly caused due to the waiting of the fire brigade in the traffic signals. It would be of great use to the fire brigade if the traffic signals in the path of the accident place are ON. Thus we propose a new design for automatically controlling the traffic signals and achieving the above mentioned task so that the fire brigade would be able to cross all the traffic
Junctions without waiting. Every traffic junction will have a controller controlling the traffic flow.

The traffic junctions are referred to as nodes and each node will have a GSM (Global System for mobile communication) modem connected to the controller. The nodes are controlled by a main server by sending the control messages to their GSM (Global System for mobile communication) modems. When a node is controlled and its traffic signal is made to be green for the Fire brigade to pass through without waiting, it is said to be in ON STATE as mentioned by Athvan and Jagdeeshwaram in (2012). For Easy access the server maintains a database for each node, and hence each node will have a unique ID for addressing it and its GPS (Global Positing System) Coordinates are also stored in the database as by Athvan and Jagdeeshwaram in (2012). Thus using these data and shortest path method as mentioned by Deo Pang (1984). And the fire brigade is guided to the accident place by the server through the shortest route.

II. Automatic Movement Of Fire Brigade Vehicle System

Our system consists of four main units, which coordinates with each other and makes sure that Fire Brigade reaches the place without any time lag. Thus our system is divided into following three units,

- The Vehicle /Fire Brigade Unit(FBU)
- The Traffic Junction Unit(TJU)
- The Main Server

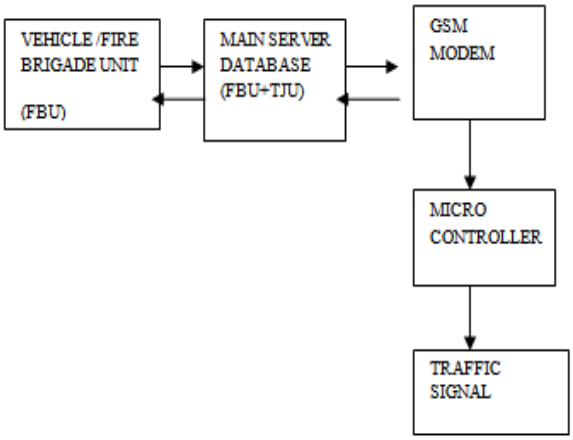

Fig. 1 Three main units of system

2.1 Vehicle/Fire Brigade Unit

According to our system, every vehicle/Fire Brigade should have a vehicle unit number. The vehicle unit consists of a vibration sensor, controller, siren, a user interface, GPS (Global Positing System) system and a GSM (Global System for mobile communication) module. The vibration sensor used in the vehicle will continuously sense for any large scale vibration in the vehicle as mentioned by Wei and Hanbo in (2011). The sensed data is given to the controller.

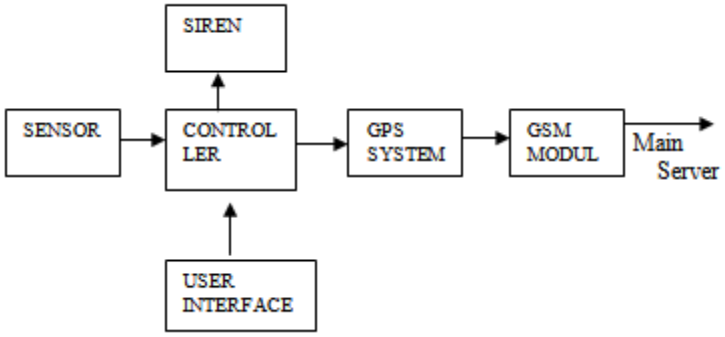

Fig. 2 Vehicles /Fire Brigade Unit

The controller compares it with a threshold value which is an empirical value (for an accident place) and if it equals or exceeds that, then the controller automatically switches on a siren inside the vehicle. A programmed timer is also triggered. In case of a minor emergency, the passenger probably would not need the service of the Fire brigade, and can therefore switch off the siren before the timer counts to zero, by resetting the entire vehicle unit through the user interface, which is connected to the controller. If he is unconscious or fatally wounded and needs a Fire brigade, then the siren is left ON and when the timer counts to zero, it would trigger both the GSM (Global System for mobile communication) MODULE and the GPS (Global Positing System) SYSTEM inside the fire brigade vehicle. The GPS (Global Positing System) SYSTEM finds out the current position of the fire brigade vehicle which is the location of the emergency spot and gives that data to the GSM (Global System for mobile communication) MODULE. The GSM (Global System for mobile communication) MODULE sends this data to the MAIN SERVER whose GSM (Global System for mobile communication) number is already there in the module as an emergency number. The vehicle unit is shown in the Fig 2.

2.2 Main Server

The main server is the central brain of our ITS (Intelligent Transportation System). It communicates as well as controls every part of the system. The server objectives can be mainly classified into:

- Finding the Nearest Fire Brigade to the Accident Spot.
- Allotting Shortest Path for the Vehicle from Source to Destination.
- Controlling the Nodes/Traffic Light in the Shortest Path

Finding the nearest Fire Brigade to the accident spot

The server maintains a database of the Fire Brigade available. The server selects the nearest Fire Brigade to the accident spot using the database containing the details of free and busy Fire Brigade at that point of time. Then the server scans the locations of the free Fire Brigade in the database. It calculates the distance between the accident spot and each Fire Brigade. Then it compares all the distances calculated and selects the nearest Fire Brigade that is to be directed for reaching the spot as mentioned by Tawara and Mukai in (2010).
Therefore for performing the above functions, the server must have the following databases:

- Fire Brigade database - contains list of free and busy Fire Brigade along with the unique fire brigade number.
- NODE database – The Main Server allocates a unique ID for each traffic light nodes and has a database to containing all the nodes' IDs, GSM(Global System for mobile communication) numbers and their GPS (Global Positing System) coordinates.

2.2.1 Shortest Path Using Dijkstra Algorithm

A node can possibly operate in two modes namely, the normal mode and the Fire Brigade mode. Normal mode is usual traffic control by a micro controller in a junction. In normal mode, traffic flow in each direction of the mode will be given equal importance as mentioned by Panahi and Delavar in (2009). In the Fire Brigade mode, the direction in which the Fire Brigade heads is given importance and is kept in the ON state, till the Fire Brigades leaves the junction (node). This is done by

- The node will receive a START SIGNAL from the main server as a control message which contains the direction that must be kept in ON state so that the Fire brigade can pass through the junction without waiting.
- The direction retrieved from the control message is given to the micro controller.
- That particular direction is kept in the ON state as long as another message (STOP SIGNAL) is received from the main server.
- The STOP SIGNAL is generated when the GPS (Global Posting System) coordinates of the Fire Brigade and the node matches i.e. when the Fire Brigade crosses then node. The node then will return to its normal mode of operation.

Interrupt Service Routine Algorithm for Node

- WAIT FOR THE RECEPTION OF START MESSAGE ALONG WITH THE DATA
- RETRIEVE THE DATA ABOUT THE SIGNAL TO BE MADE GREEN
- MAKE THE CORRESPONDING SIGNAL TO BE GREEN
- WAIT FOR THE RECEPTION OF NEXT MESSAGE OR STOP SIGNAL
- IF THE MESSAGE IS RECEIVED RETURN TO NORMAL MODE

By this way each node in the path to the hospital is controlled by the server. This function can be divided into two phases:

The shortest path between the nodes can be selected using the DIJKSTRA algorithm. Consider a case when the Fire Brigade travels from source to accident spot. The database in the server as said earlier contains the node and the distance between the adjacent nodes to which it is connected. The accident spot is taken as the destination and the fire brigade location is taken as the source as

Mentioned by Nazari and Meybodi in (2008). The node next to the fire brigade spot and the node in the path to destination must be traced. So that fire brigade node is taken as source and the accident node is taken as destination and the DIJKSTRA algorithm is applied for shortest path finding. There may be several paths between these nodes and the algorithm finds the shortest path. There may be one way roads along this path, therefore this must be a vector quantity. The server finds nearest node from source and marks it as visited. Then that node is considered as source and the procedure is continued till the destination. Initially, the source doesn't know the distance to destination, so it will be infinite and after complete computation the shortest path along with the distance will be known

2.2.3 Allotting Shortest Path for the Vehicle from Source to Destination.

The server will also find the nearest destination and calculates the shortest path connecting the Fire brigades current location, the accident spot and the nearest destination. The shortest path will contain nodes in the path. The server takes the GPS (Global Positing System) coordinates of all the nodes in the shortest path from the NODES database and along with GPS (Global Positing System) coordinates of the accident spot and the Destination it transmits it to the Fire Brigade unit in a format specified below. The nodes coordinates alone are sent to the Fire Brigade. The format for sending the node coordinates is:

The last two coordinates (Xn-1, Yn-1) and (Xn, Yn) will indicate the accident location and the destination location respectively.

2.2.4Controlling the Nodes/Traffic Light In the Shortest Path

The nodes in the shortest path are accessed and **controlled only when the Fire Brigade reaches a distance of around say 100m from the node**. These locations are stored as the 100m markings. Since the signal should not be kept in ON state for a long time, the node access control is done in the following steps:

- The server first plots a map with the nodes needed for the shortest path and makes 100m markings for each node.
- The locations of 100m markings are taken from the map and stored in the NODES database.
- When the Fire Brigade's GPS(Global Positing System) location and location of any one of the 100m markings matches, the corresponding GSM(Global System for mobile communication) ID with the signal direction from the map is taken by the server and is compared with the shortest path nodes' GSM(Global System for mobile communication) IDs.
- If that node is present in the path, the START SIGNAL is sent to that GSM (Global System for mobile communication) ID.
- Now, the node is kept in ON state till the Fire Brigade crosses the node. Once it crosses the node, the server sends a STOP SIGNAL to the node which brings the node to normal mode of operation.

2.3The Traffic Junction Unit

A node can possibly operate in two modes namely, the normal mode and the Fire Brigade mode. Normal mode is usual traffic control by a micro controller in a junction. In normal mode, traffic flow in each direction of the mode will be given equal importance. In the Fire Brigade mode, the direction in which the Fire Brigade heads is given importance and is kept in the ON state, till the Fire Brigade leaves the junction (node). This is done by

X1,y1	X2,Y2	..	...	Xn-1,Yn-1	Xn,Yn

- The node will receive a START SIGNAL from the main server as a control message which contains the direction that must be kept in ON state so that the Fire Brigade can pass through the junction without waiting.
- The direction retrieved from the control message is given to the micro controller.
- That particular direction is kept in the ON state as long as another message (STOP SIGNAL) is received from the main server.
- The STOP SIGNAL is generated when the GPS (Global Positing System) coordinates of the Fire Brigade and the node matches i.e. when the Fire Brigade crosses then node. The node then will return to its normal mode of operation.

III. CONCLUSION

This paper proposes for controlling the traffic signals in favor of Fire Brigade movement at the time of emergency call. With this system the Fire Brigade can be reached to the accident spot without time lag. The AMFBVS can be proved to be effectual to control not only Fire Brigade but also authoritative emergency vehicles. Thus AMFBVS if implemented in state with large population like Chhattisgarh State can produce better results. Chhattisgarh include large number of tribal area and The propose system can be used in providing services to tribal people .AMFBVS is more accurate with no loss of time.

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